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Genetic Relationship between Live Animal Ultrasound Measures and Scrotal Circumference in Yearling Angus Bulls

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Abstract
The purpose of this study was to determining the relationship between 365-d yearling scrotal circumference, scanning weight, and component ultrasound measured compositional traits. The genetic correlations between scrotal circumference measured at 365-d of age and other live animal measures are low. Of these five genetic relationships, the highest correlation is with % intramuscular fat (IMF) at .13. However, this is a low genetic correlation. The positive sign of the scrotal circumference-% IMF genetic correlation is encouraging for breeders wanting to increase scrotal circumference and % IMF at the same time. Scrotal circumference in yearling Angus bulls is not strongly linked genetically with weight and compositional traits. Selection programs for either increased retail product (as measured by weight and ribeye area) or quality (as measured by % IMF) will not result in an antagonistic effect on scrotal circumference.

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Summary

The purpose of this study was to determining the relationship between 365-d yearling scrotal circumference, scanning weight, and component ultrasound measured compositional traits. The genetic correlations between scrotal circumference measured at 365-d of age and other live animal measures are low. Of these five genetic relationships, the highest correlation is with % intramuscular fat (IMF) at .13. However, this is a low genetic correlation. The positive sign of the scrotal circumference-% IMF genetic correlation is encouraging for breeders wanting to increase scrotal circumference and % IMF at the same time. Scrotal circumference in yearling Angus bulls is not strongly linked genetically with weight and compositional traits. Selection programs for either increased retail product (as measured by weight and ribeye area) or quality (as measured by % IMF) will not result in an antagonistic effect on scrotal circumference.

Introduction

Real-time ultrasound has opened the door to opportunities for studying growth and development in beef cattle as never before. This tool is being used to annually measure thousands of young seed stock animals directly to determine genetic merit for compositional traits. The indications are that yearling bulls can be scanned for traits of external fat, ribeye area, and percentage intramuscular fat (% IMF) to accurately predict these same traits in steer progeny destined for harvest. One of the issues that is unresolved is the relationship between what is happening to lean and fat deposition when the young bull begins to mature sexually. Particularly questioned is whether the process of achieving sexual maturity has any effect on the deposition or levels of % IMF that could potentially bias carcass expected progeny differences (EPD) based ultrasound measures. The purpose of this study was to determining the genetic relationship between 365-d yearling scrotal circumference, scanning weight, and component ultrasound measured compositional traits.

Materials and Methods

Twice annually, Iowa State University (ISU) conducts a genetic evaluation of scrotal circumference in yearling bulls for the American Angus Association. ISU is also conducting a genetic evaluation for ultrasound measured traits in yearling Angus bulls and developing Angus heifers. For the Spring-2000 evaluation, there were 128,518 scrotal records and 29,938 yearling bull ultrasound records. There were 11,852 yearling bulls having both scrotal measures and ultrasound measures, and these animals were used to conduct this study. There were 1,191 sires represented by these yearling bulls. Both scrotal and ultrasound measures were adjusted to a 365-d age end point and for age of dam effects. A summary of the adjusted records is presented in Table 1.

A multiple-trait sire-maternal grandsire model was used to estimate the genetic variance-covariance parameters using restricted maximum likelihood procedures. Contemporary group effects fit in the same model included herd, weaning contemporary group, and scanning contemporary group.

Table 1. Adjusted yearling Angus bull live scan and scrotal circumference measures (11,852 head)

Trait	Mean	Std. Dev.	Minimum	Maximum
Scan weight, lbs	1075	110	587	1553
Gain, lbs/d	2.95	.55	.31	5.67
% IMF, %	3.42	.82	1.07	8.49
Ribeye area, sq. in.	12.06	1.38	6.00	17.7
12-13th rib fat, in.	.25	.10	.03	.93
Rump fat, in.	.30	.10	.02	.87
Scrotal cir., cm	36.2	2.6	23.1	49.0

Results and Discussion

The heritability, genetic correlation and phenotypic correlation estimates are presented in Table 2. The Heritability estimates are consistent with estimates previously derived from the independent data sets (ultrasound and scrotal).

The genetic correlations between scrotal circumference measured at 365-d of age and other live animal measures are

low. Of the five genetic relationships, the highest is with % IMF at .13. However, this is a low genetic correlation. The positive sign of the scrotal circumference-% IMF genetic correlation is encouraging for breeders wanting to increase scrotal circumference and % IMF at the same time. The largest correlation is a phenotypic correlation with scanning weight at .27. This correlation suggests larger bulls are going to have larger testicles at a year of age. The other phenotypic correlations are small, but positive.

The next step in more fully understanding the sexual maturity and growth and development patterns in yearling Angus bulls will be to study within-animal growth curves for each of these two traits. This research is ongoing at ISU as part of the beef cattle breeding project. Serial measurements of these traits from weaning to harvest are being collected annually on intact males starting with the 1998 calf crop. The first results from an analysis of three years of data will be available mid-summer 2001.

It should be noted that the h^2 level for scrotal circumference is in the moderate range (.34). With a h^2 of this magnitude, selection can be used to increase (or decrease) circumference.

Table 2. Heritability, genetic correlation and phenotypic correlation estimates for yearling Angus bull live scan and scrotal circumference measures (365-d age end point).

Trait	SWT	% IMF	REA	FAT	SCR	RFAT
Scan weight (SWT)	.57[a] (.06)	-.16[b]	.30	.11	.05	.12
% IMF	.00[c]	.32 (.05)	-.07	.24	.13	.16
Ribeye area (REA)	.40	-.07	.34 (.05)	.20	.05	.10
12-13th rib fat (FAT)	.30	.19	.19	.37 (.06)	.06	.66
Scrotal (SCR)	.27	.03	.12	.12	.34 (.05)	.06
Rump fat (RFAT)	.24	.16	.13	.60	.11	.36 (.06)

[a]Heritability with standard error in parenthesis.
[b]Genetic correlations on the upper off-diagonals.
[c]Phenotypic correlations on the lower off-diagonals.

Implications

Scrotal circumference in yearling Angus bulls is not strongly linked genetically with weight and compositional traits. Selection programs for either increased retail product (as measured by weight and ribeye area) or quality (as measured by % IMF) will not result in an antagonistic effect on scrotal circumference.

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